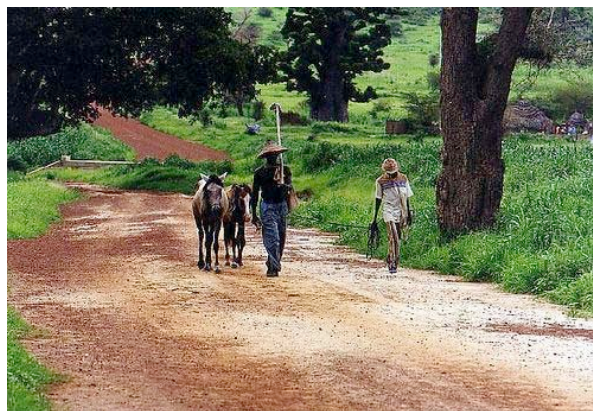


*Open Access: scientific publishing and the developing world

Advances in science, medicine, technology and agriculture have potential to contribute to the reduction of disease and poverty worldwide. Communications and information technology (ICT) has enabled collaboration and dissemination of scientific research on a global scale. In the words of UN Secretary-General Kofi Annan, 'we are fortunate to live in an age that offers new opportunities for involving all nations in science and technology' (1). However, scientists in the developing world are severely restricted in their access to current research. The open access (OA) model of publishing has often been suggested as a means of mitigating some of the restrictions faced by scientists in low-income countries, and has made significant progress in improving free access to research. However, as it emerges into the mainstream, the OA model must also face questions concerning its implications for the global distribution of intellectual property, widespread integration, and financial viability.



African men returning from their farm

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Open access in theory and practice

The basic philosophy of OA is that the publicly funded research emerging from universities and research institutions should be freely available to researchers working to benefit the public, rather than subject to fees imposed by publishers. OA refers primarily to material distributed in electronic form on the Internet (e-prints). This can include publications in OA journals, which make published articles available upon initial publication, or before (pre-prints) or after (post-prints) publication elsewhere. OA repositories are searchable collections of freely accessible material that can include OA journal articles, pre-prints, or post-prints.

Initiatives and organizations promoting OA emerged alongside the Internet from the early 1990's, and gathered force in the first years of this century as a reaction to the restriction of scientific research under subscription or 'pay-per-view' models of online publishing. The specialist open-access publisher BioMed Central ([BMC](#)) and the more recent arrival Public Library of Science ([PLoS](#)) continue to expand their journals and content. All content is automatically archived in PubMed Central and several other OA archives. BMC also assists institutions in developing their own research repositories, as does the Scholarly Publishing and Academic Resources Coalition ([SPARC](#)). Repositories are often developed using open source software; two of the best-known options are [DSpace](#) developed at MIT in the US, and [EPrints](#) from the University of Southampton in the U.K.

In recent years many, publishers, funding bodies, and renowned scientists have provided support to the OA movement, and thus bolstered the scientific prominence of freely available science. In the past year, the US National Institutes of Health ([NIH](#)), the [UK Research Councils](#), and the [Wellcome Trust](#), have mandated that all work they fund to be deposited in an open access archive within a short period after publication. Further, established journals operating on a traditional paid subscription model have shifted policy to accommodate the demand for OA science. The Nature Publishing Group ([NPG](#)), for example, has announced that starting in January 2007, all content published more than 4 years prior will be made available online. Finally, 25 provosts from leading research institutions in the U.S. have written a letter ([PDF](#)) in support of a U.S. Senate Bill that would require all governmental funding bodies with budgets in excess of \$100 million to follow the lead of the NIH, and publish all resultant research in an OA repository. Active support for the OA movement from such high impact entities is encouraging across the scientific community has potential to make significance impact on science, including in developing countries.



Science complex, University of Botswana. Uploaded to <http://www.flickr.com/photos/kenyahudson/10451420/>

on April 22, 2005 by KenyaHudson.

Funding quality OA research

Despite these developments, relatively few OA journals are gaining high rankings in indices such as the Institute for Scientific Information (ISI), which deters many researchers from publishing in them. One important exception is PLoS, a model designed to prove that the open access model can be viable in publishing high quality research and whose journals PLoS Biology and PLoS Medicine are high-impact general science publications thought to aim at competition with top journals such as Nature and Science.

Publishing top quality research obviously requires the costs of editorial input, peer review, and electronic infrastructure and tools to be covered. Several alternatives have been explored to gain income from sources other than subscription fees. The most commonly used is the 'author pays' system, in which authors pay a fee towards journal publication costs. The assumption is that the cost of publication will be born by the

author's institution rather than the individual and advocates of this model argue that the expenses involved will be more than compensated for by the money saved in journal subscription costs. However, the example of PLoS also raises the question of whether the author pays model is capable of sustained financial viability. Nature recently published a news item claiming that PLoS had failed to achieve its stated aim of breaking even, losing almost \$1 million in 2005, and had consequently been forced to increase its author charges from US\$1,500 per article to as much as \$2,500, as well as being reliant on philanthropy to cover its costs (2).

Most open-access journals agree to waive author fees in the case of authors based at institutions in developing countries. However, there remains concern that the need to raise revenues could lead to a financial bias in editorial decisions against those authors who would qualify for exemption from the charges.

An alternative to the full author-pays model is the 'sponsored article' model which has recently been adopted by Elsevier journals and by the Royal Society under its [EXis open choice model](#). In this case, after the peer review process, authors are offered the option of paying a fee to ensure their articles are freely available. However, as there is no plan to waive author charges in this model, it is unlikely that cash-strapped institutions in the developing world are likely to take up this option. In fact, this could lead to an increase in the current trend for research from authors in industrialised countries to be more widely read, as it is more likely to be freely available.

Open access and developing countries

Research in low-income countries is compromised by multiple factors: resources may be limited, equipment less than optimal, and basic infrastructure, such as electricity supplies, unreliable. Among these barriers is the issue of access to current research. While the number of specialist academic journals continues to rise, the average price of a science journal has risen four times faster than inflation for the past two decades, resulting in an 'access crisis' in which libraries are forced to cancel journal subscriptions (3). This worldwide problem is magnified in low-income countries; even state institutions are often unable to meet the rising costs of journal subscriptions. Although the Internet has largely overcome the problems, including delays and theft, associated with physical distribution of journals, the price barrier remains insurmountable in many cases. It is therefore widely thought that open access will be particularly beneficial to researchers in less developed countries

OA initiatives that target less wealthy nations or regions can be broadly divided into those that aim to increase the access to resources, those aiming to increase the visibility of work of authors from these areas and those which aim to increase knowledge of the available resources.

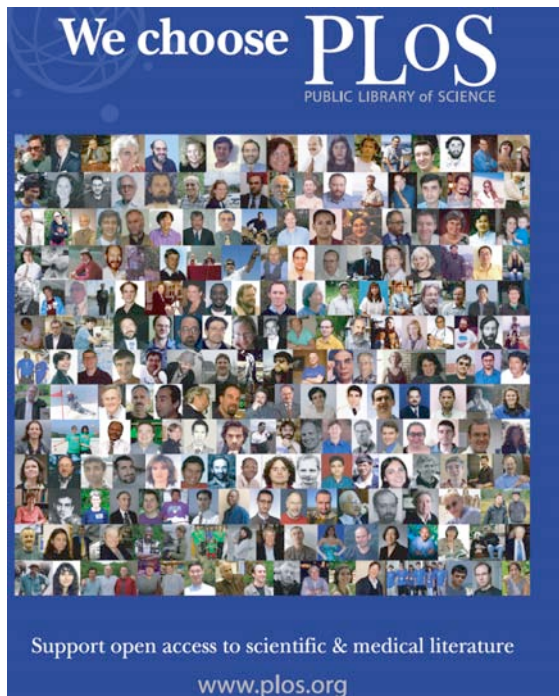
Access

Diverse initiatives targeted at improving access to science, technology, and medical research in the developing world have arisen from the 1990s onwards. Two of the most high profile international initiatives are [HINARI](#) and [AGORA](#).

In January 2002 the World Health Organisation (WHO) launched HINARI (Health InterNetwork Access to Research Ini-

tative) as part of a wider scheme to improve communication between researchers (3). HINARI provides free or reduced-rate access to over 2000 medical, biomedical and social sciences journals for researchers working in designated countries, via an interface with publishers' websites. Access is limited to state institutions and does not encompass non-governmental organizations (NGOs) or smaller hospitals, and the qualifying criteria are stringent. Furthermore, despite qualifying on the basis of a nominal cut-off point of \$3000 GNP per capita, India and other transitional states are not eligible. Nevertheless, positive feedback from users in Asia, Africa, South America, and Eastern Europe also testifies to the value of this resource. A sister UN program, AGORA (Access to Global Online Research in Agriculture) operates in a similar fashion for agricultural research publications.

Several publishers have also taken steps to increase the ability of researchers in developing countries to both access and contribute to academic literature by offering free or reduced price access to journals and/or waiving author charges. To review and develop these moves will be an important task for organisations such as the [Task Force on Science Journals, Poverty, and Human Development](#) set up in 2005 by the Council for Science Editors as a forum for journal editors.



Publicity poster for PLOS. Downloaded from <http://www.plos.org/downloads/choose.html>

search and health interventions. Additionally, INASP fosters closer associations between partners in different countries. Transfer of knowledge and expertise between developing countries has to date been extremely limited; however 'South-South' research collaborations are poised for progress over the next decade, with renewed trade and development contacts, for example, between Africa and China.

Collaboration between researchers in wealthy nations and less developed regions is an informal way to improve scientific communication outside the traditional model of journal publishing. However, such links can be constrained by institutional regulations. Dr Maria Sanchez of the University of California points out that currently, overseas collaborators are not usually granted access privileges, but that 'one way of facilitating access to journal resources would be for institutions in high-income countries to grant this kind of service to collaborators in low-income countries, or in general to institutions in low-income countries with which they have relevant ties'. In technical terms, such collaboration could be facilitated by integrating the various 'end-user identities' used by universities and research institutions to allow controlled access from other institutions.

Publishing

Alternative OA journals and repositories, which focus on research emerging from the developing world, are becoming increasingly prominent. Some notable examples include [Bioline International](#), which hosts electronic OA versions of developing country journals, [SciELO](#), containing journals published in Latin American countries and Spain (2), the [Indian Medlars Centre](#), and [African Journals Online](#). Their integration into mainstream archives like PubMed seems far off, however. Such integration will be vital if the OA model is to seriously challenge the gap between access to cutting-edge scientific knowledge in wealthy and less wealthy countries.

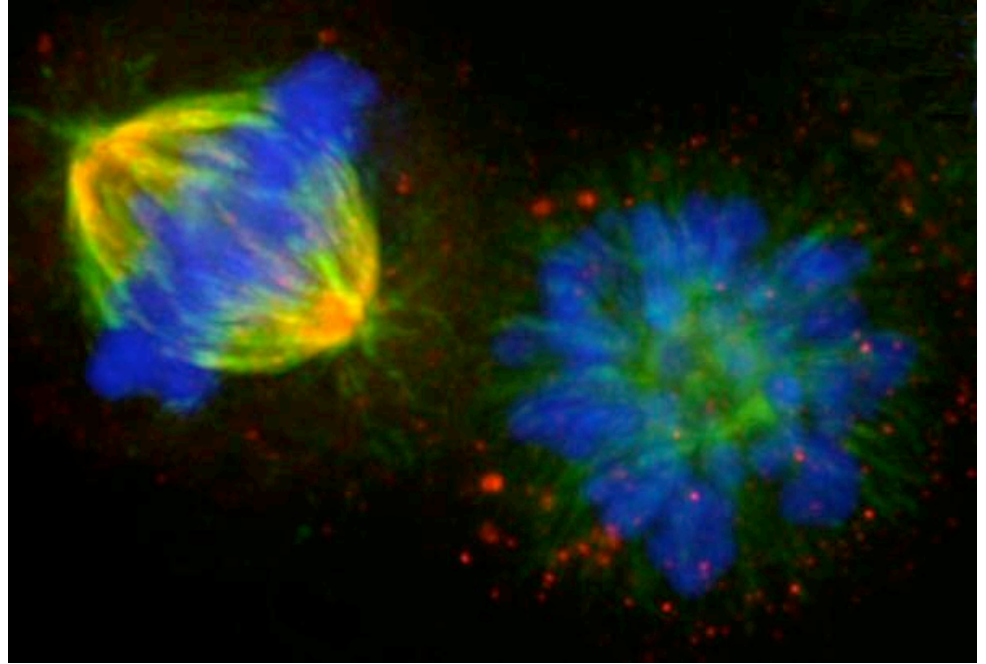
Information and collaboration

The provision of resources is not sufficient to improve access. Awareness of OA remains low in both the developed and developing world. As the drive towards open access to science developing countries gathers momentum, encouraging the best use of available resources is the next logical step. Since its inception in 1992, the International Network for the Availability of Scientific Publications ([INASP](#)), a UK-based charity, has worked with partners across the world to facilitate access to online publications through workshops, training, library capacity building, and skills development. INASP also recognizes the importance of outreach programs to rural communities, particularly in view of agricultural re-

Conclusions

There is little doubt that open access initiatives have greatly improved the potential access of authors in low income countries to scientific research. Nevertheless, in the case of agreements which allow open access to findings that are usually restricted under subscription or pay-per-view models, there are strong arguments that the scope of institutions, as well as the range of countries that are granted open access, should be enlarged. Further, there is a need for the provision of information about open access in an accessible form (and language) and the training of information professionals and scientists in less industrialised nations to ensure that those who could benefit from them are aware of and able to use open access resources.

The question of whether open access allows the work of authors from less developed countries to gain more exposure is less straightforward. The author pays model presents obvious problems for less affluent institutions, as well as the more subtle issues of editorial decision making where charges are waived. Great care needs to be taken that some aspects of this model, and especially of 'hybrid' models where charges to allow open access are an option, do not act to reinforce the dominance of the industrialised countries over the scientific literature rather than challenging it. Finally, while gateways and repositories focusing on journals from a specific country or region are useful, the development of subject-specific resources containing the work of authors from both wealthy and less wealthy nations in a range of languages is vital to prevent the development of a 'two-tier' system of open access publishing and archiving.



One of BioMed Central's striking 'images of the month' Taken from: Stout et al., BMC Cell Biology 2006, 7:26 [[View article](#)]

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